



# Applications for the Intelligent Transportation System

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**Assistant Director**

Dec 2, 1999



# Observational Studies



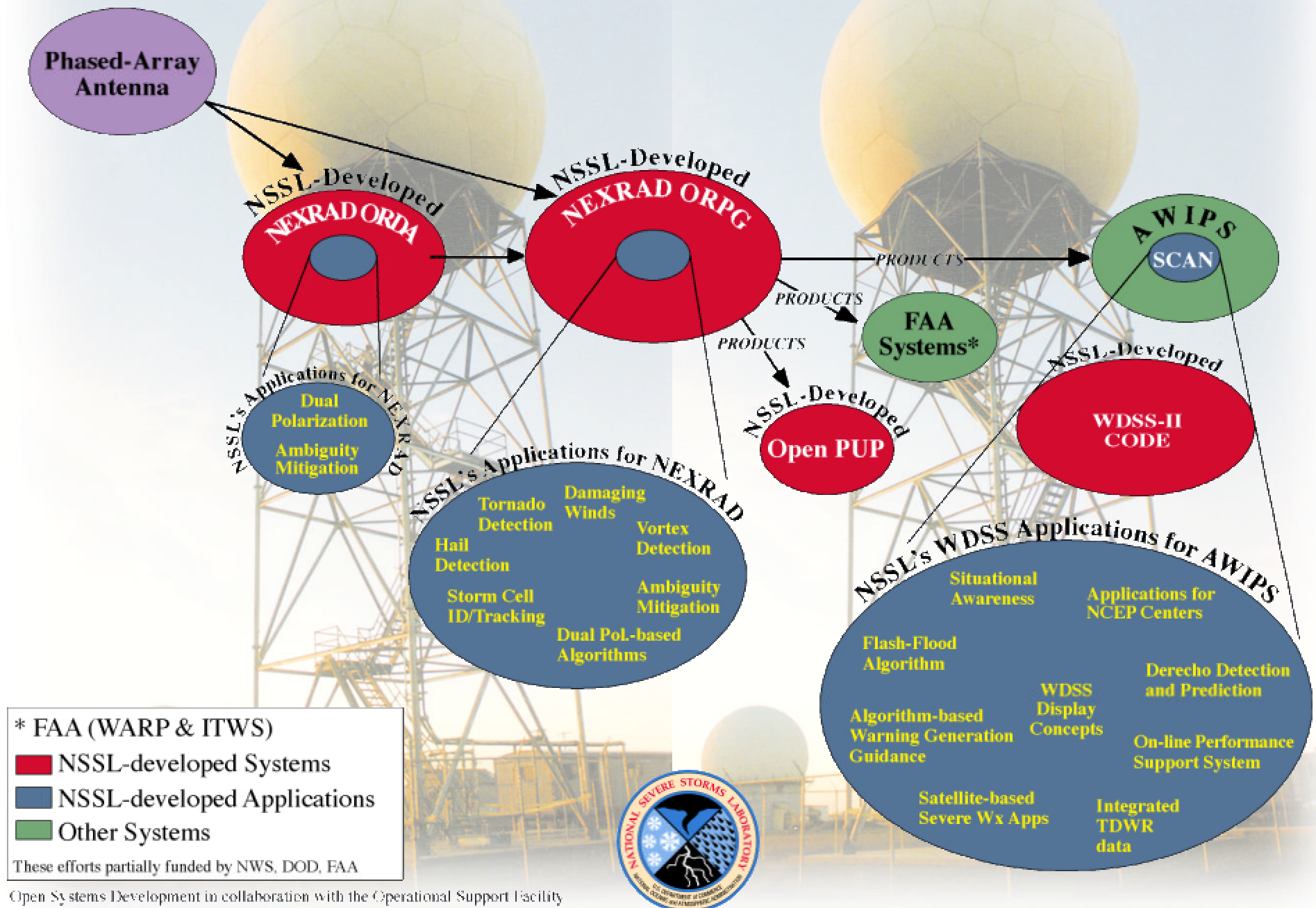
To work in partnership with the National Weather Service to enhance NOAA's and our other customers capability of providing accurate forecasts and warnings of all types of hazardous weather.

# NEXRAD Program

- Electric Utilities
- Aviation
- NASA
- DOD
- Foreign Governments



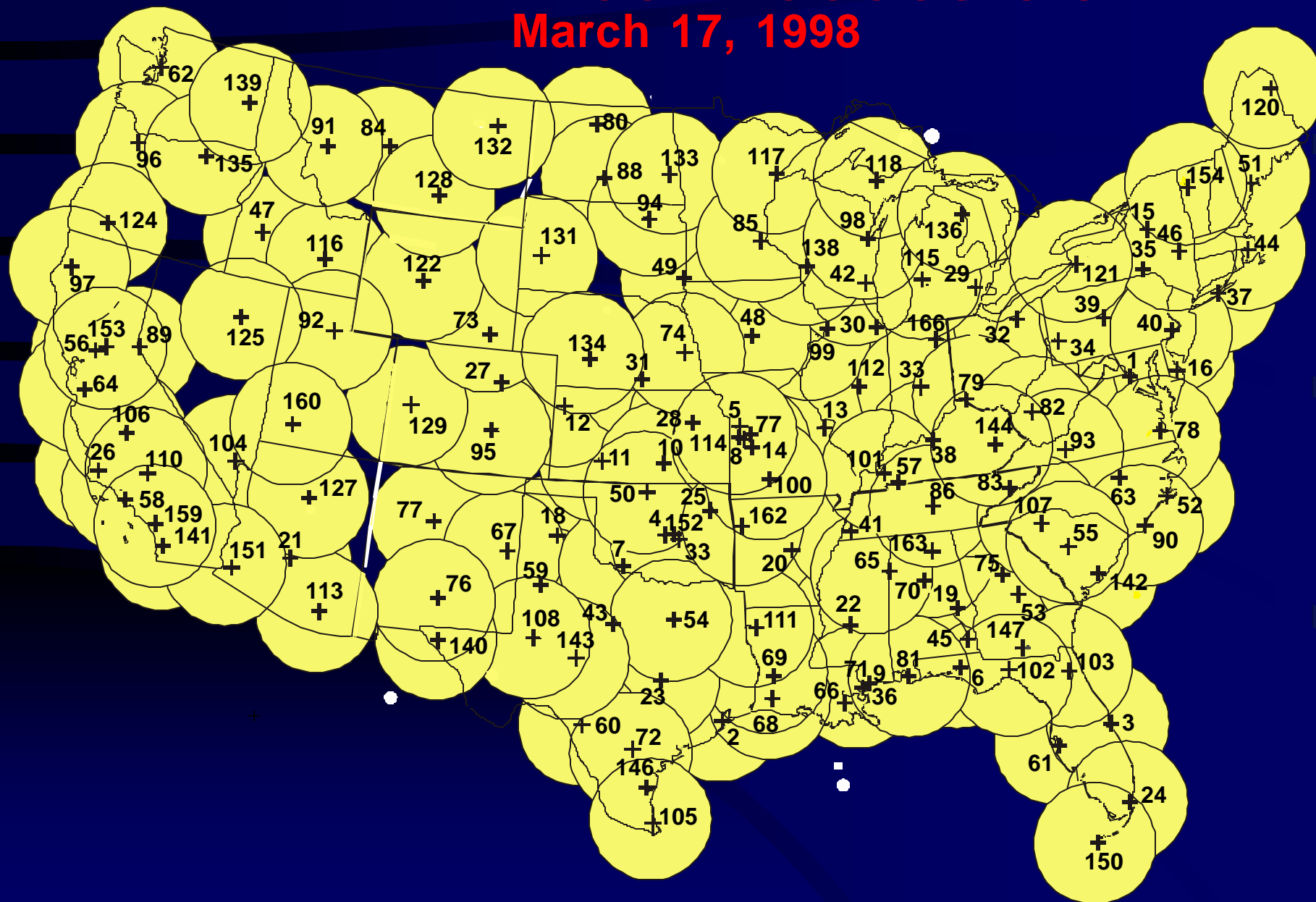
# Vision of Some of NSSL's Contributions to Weather Systems





# COMPLETED WSR-88D INSTALLATIONS WITHIN THE CONTIGUOUS U.S.

March 17, 1998





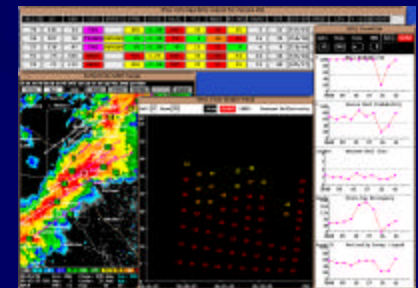
# Warning Decision Support System

- Goal is to put the right information in the hands of the forecaster in a timely fashion to help them make more effective, efficient and timely warning decisions. WDSS's role is a prototype for algorithms and display concepts for the WSR-88D and AWIPS/SCAN.



- Uses data from WSR-88D, NLDN and RUC - II.
- Utilizes image processing, expert systems, artificial intelligence and statistical techniques to turn data into useful information.

- Interactive display allows the forecaster or other user easy access to information and directs them to the most critical weather phenomena; concept is “selective disclosure”.





# Warning Decision Support System Components



## Detection, Diagnosis, and Prediction Algorithms:

- Storm Cell Identification and Tracking
- Hail Detection
- Mesocyclone Detection
- Tornado Detection
- Damaging Downburst Prediction and Detection
- Flash Flood Prediction
- Precipitation Accumulation
- Lightning Association and Threat Area
- Forecast of 30 minute and 1 hour reflectivity fields
- Snowfall Accumulation
- Dual-Polarization Algorithms (better QPE and precip type)



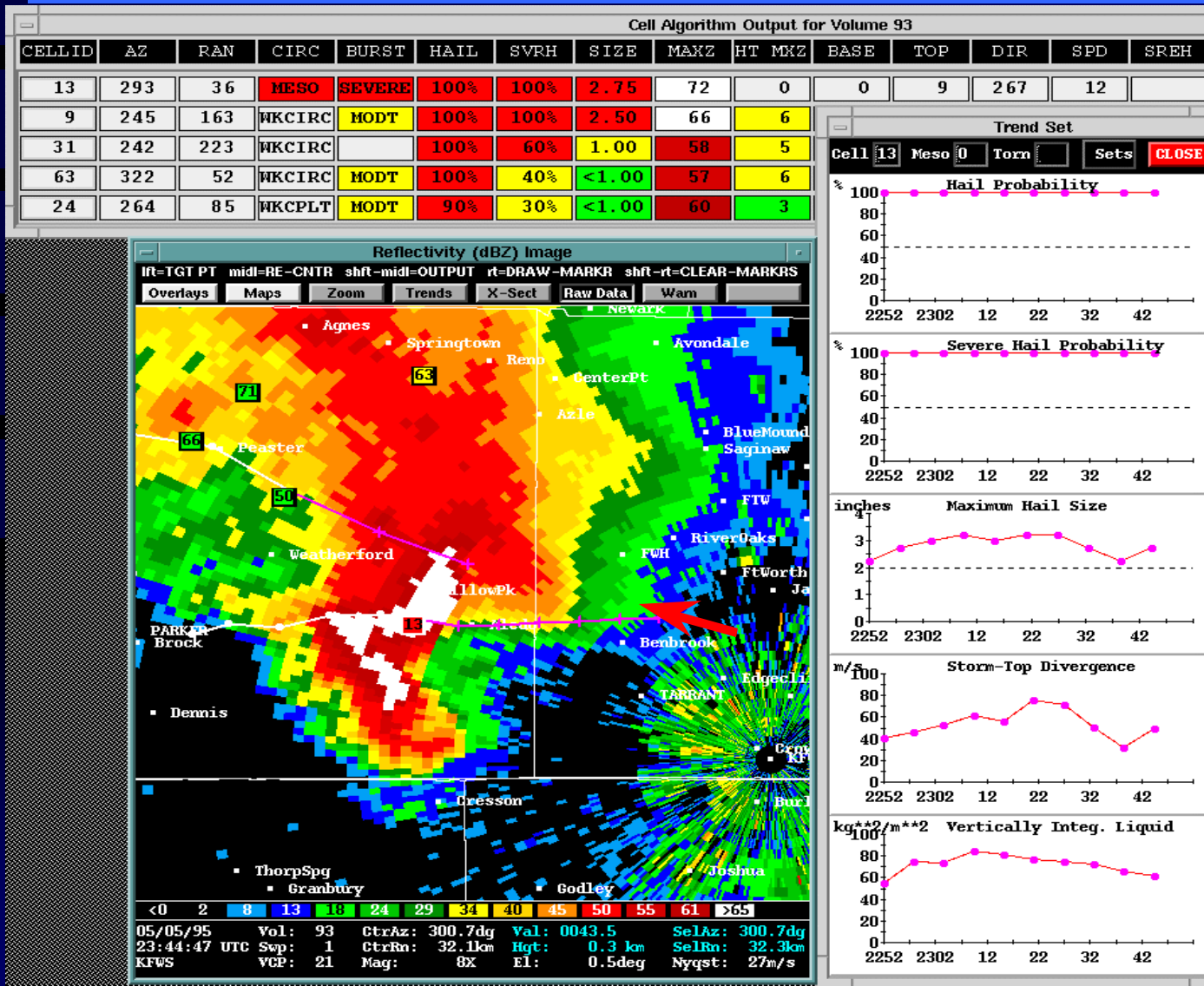
**Near-Storm Environment (NSE) Analysis - data integration to understand the thermodynamics and kinematics of the near-storm environment.**



**Interactive Display designed specifically for rapid access to the most important information**

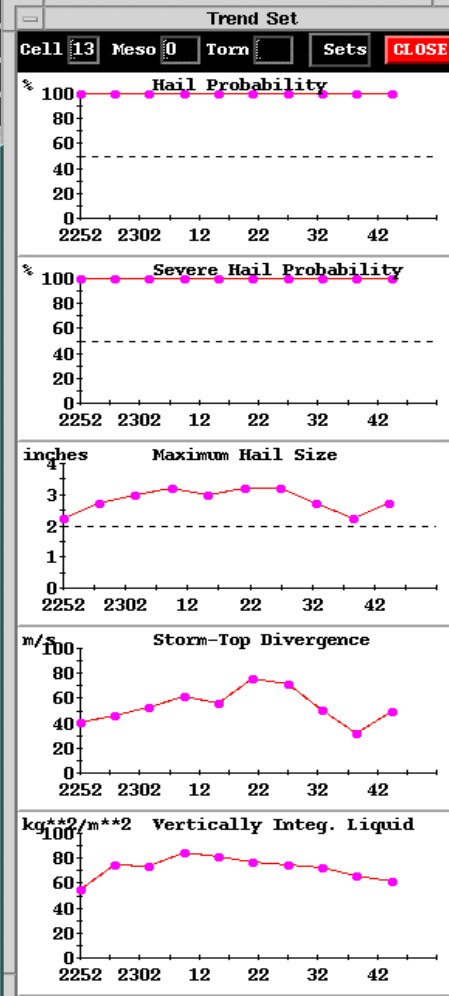


# Hail Detection and Storm Cell Identification and Tracking Algorithms



May 5, 1995

HDA detecting large hail event that caused significant damage (3.5 inch hail seriously injuring 109 people) during an outdoor Mayfest celebration. This storm continued across the DFW Metroplex, killing 18 people in flash floods and doing \$1.2 billion damage mostly from hail.



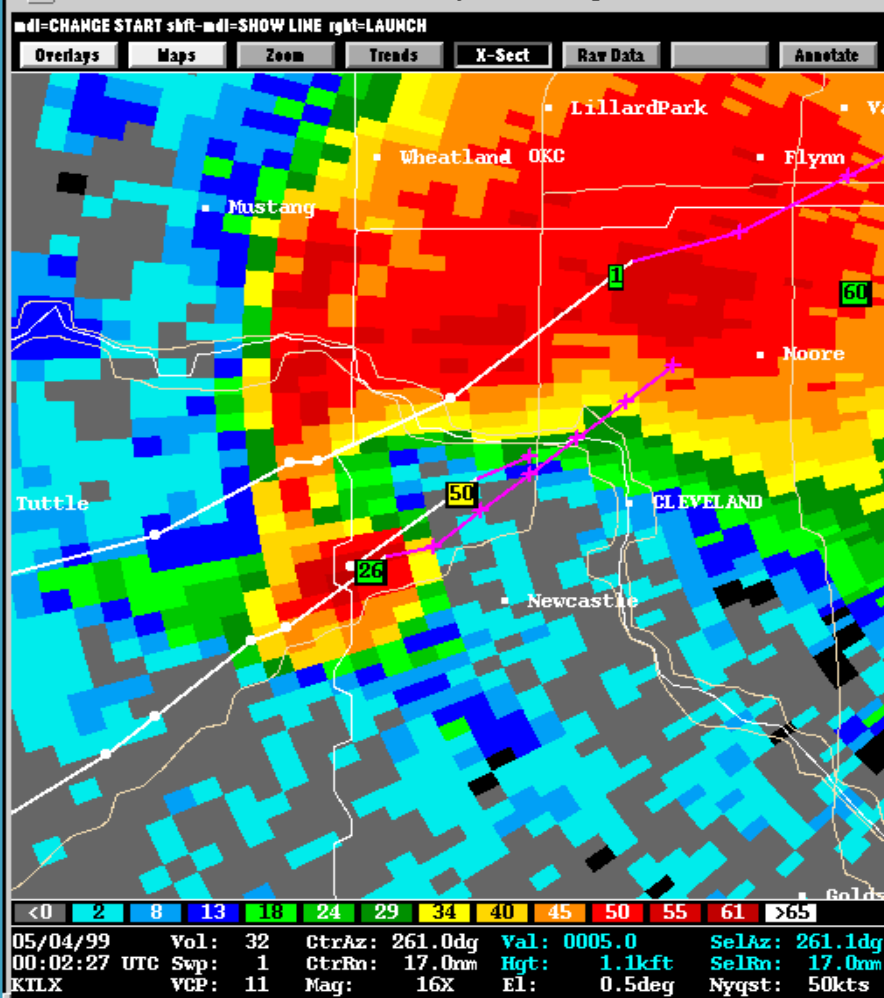


# Mesocyclone and Tornado Detection Algorithms

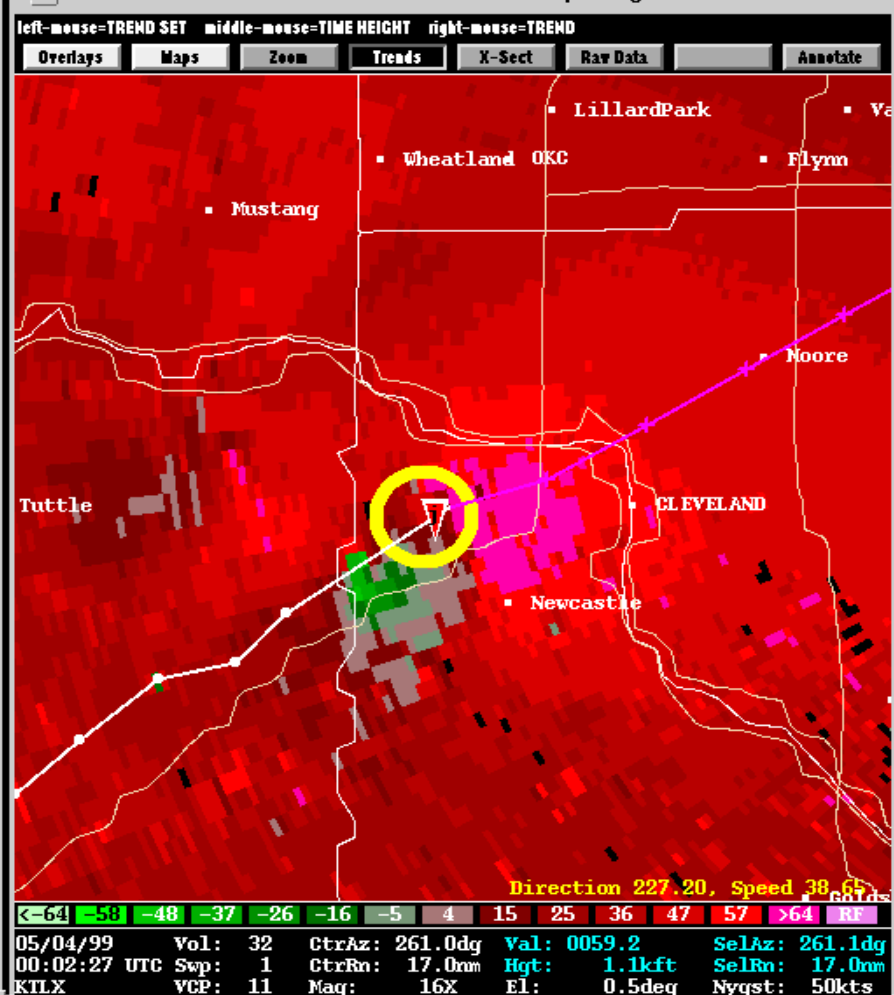
NSSL Cell Algorithm Output for Volume 32

CELLID	AZ	RAN	CIRC	BURST	SVRH	SIZE	HAIL	VIL	MAXZ	HT MKZ	BASE	TOP	DIR/SP	SREH
50	261	17	TVSMES	SEVCNV	40%	2.25	90%	28	57	22	16	28	227/17	358
51	307	44	TVSMES		20%	1.75	100%	24	53	16	8	37	236/27	381
36	258	50	MESO	SEVCNV	30%	2.00	100%	40	55	4	4	47	244/25	391
37	314	72	CIRC		40%	2.00	100%	39	55	15	7	36	207/45	121
45	329	103	CIRC		60%	1.25	100%	56	57	24	13	34	164/23	240

Reflectivity (dBZ) Image



Storm Relative Velocity Image





# Flash Flood Application Development/Testing

## Objectives

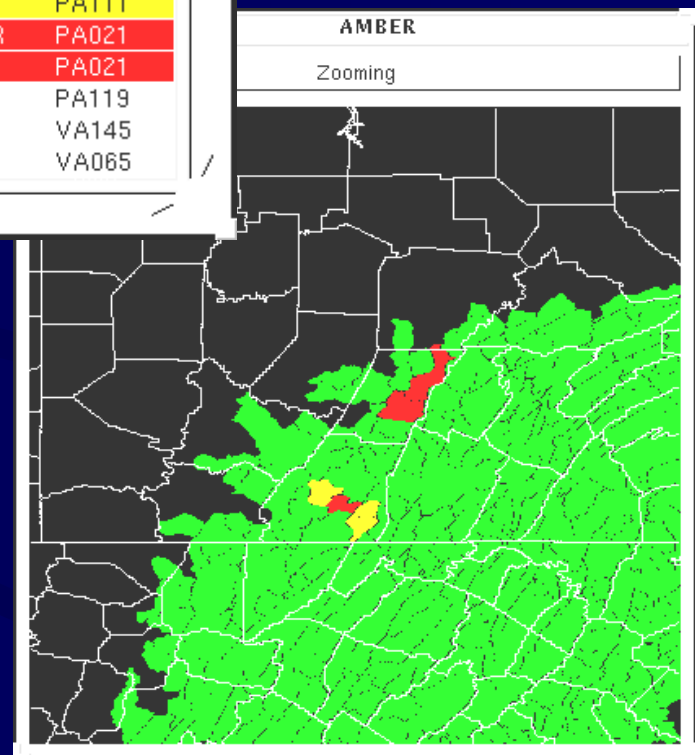
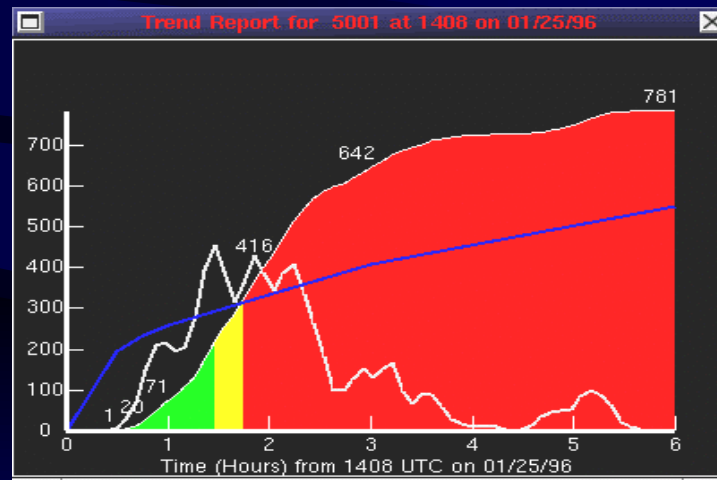


- Use integrated data sources such as radar and satellite to provide early flash flood warnings
- Use latest GIS advances to provide the best possible hydrological basin resolution



# Flash Flood Prediction

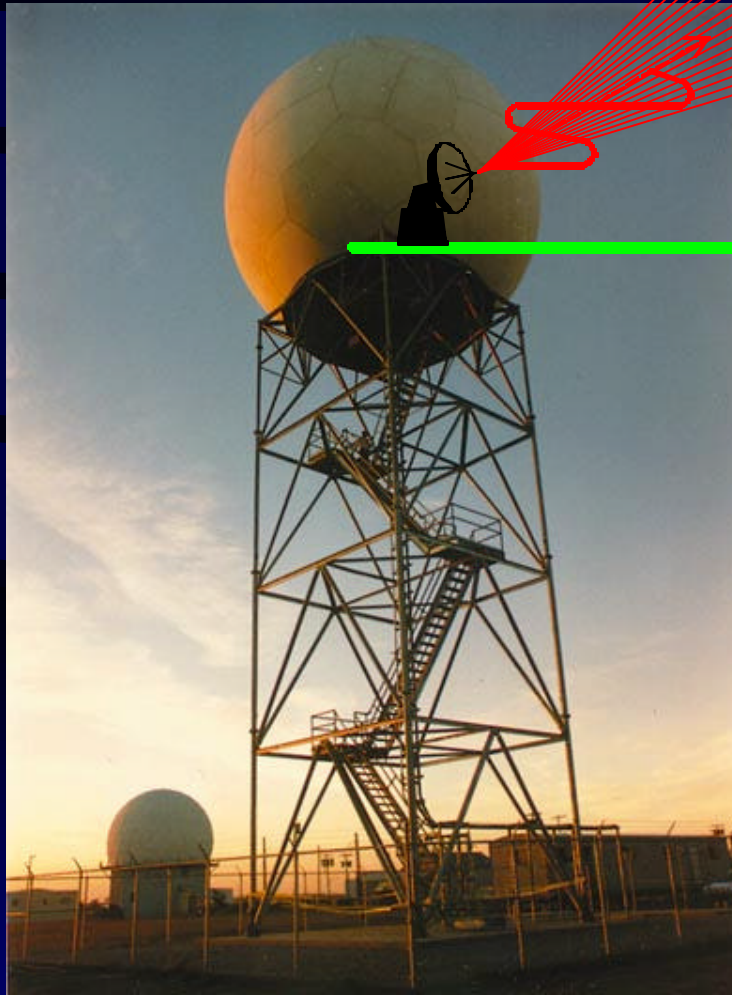
Basin #	0.5 Hr	0.75 Hr	1 Hr	2 Hr	3 Hr	6 Hr	Basin Name	FIPS
1092	66	68	71	57	47	101	Buffalo Creek	PA111
1098	68	64	62	48	39	85	Brush Creek	PA111
1086	40	50	58	51	42	94	Coxes Creek	PA111
1104	47	51	53	44	37	90	Laurel Run&Mtn Run of Wills Cr	PA111
1047	26	41	53	44	35	105	N Branch of Little Conemaugh R	PA021
1014	35	47	50	39	31	104	Clearfield Creek	PA021
1440	0	0	0	0	0	0	Penns Creek	PA119
1439	0	0	0	0	0	0	James R-Richmond	VA145
1438	0	0	0	0	0	0	James R-Cartersville	VA065





# DUAL POLARIZATION

Typical  
Precipitation  
Particles

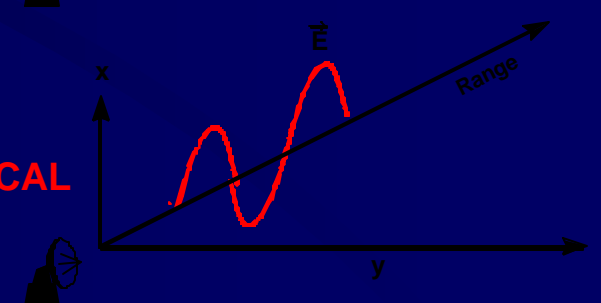
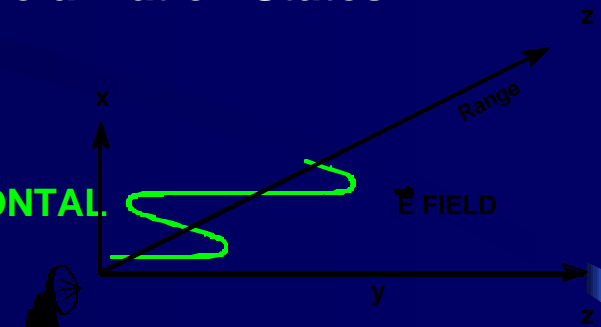


Polarization States

LINEAR HORIZONTAL

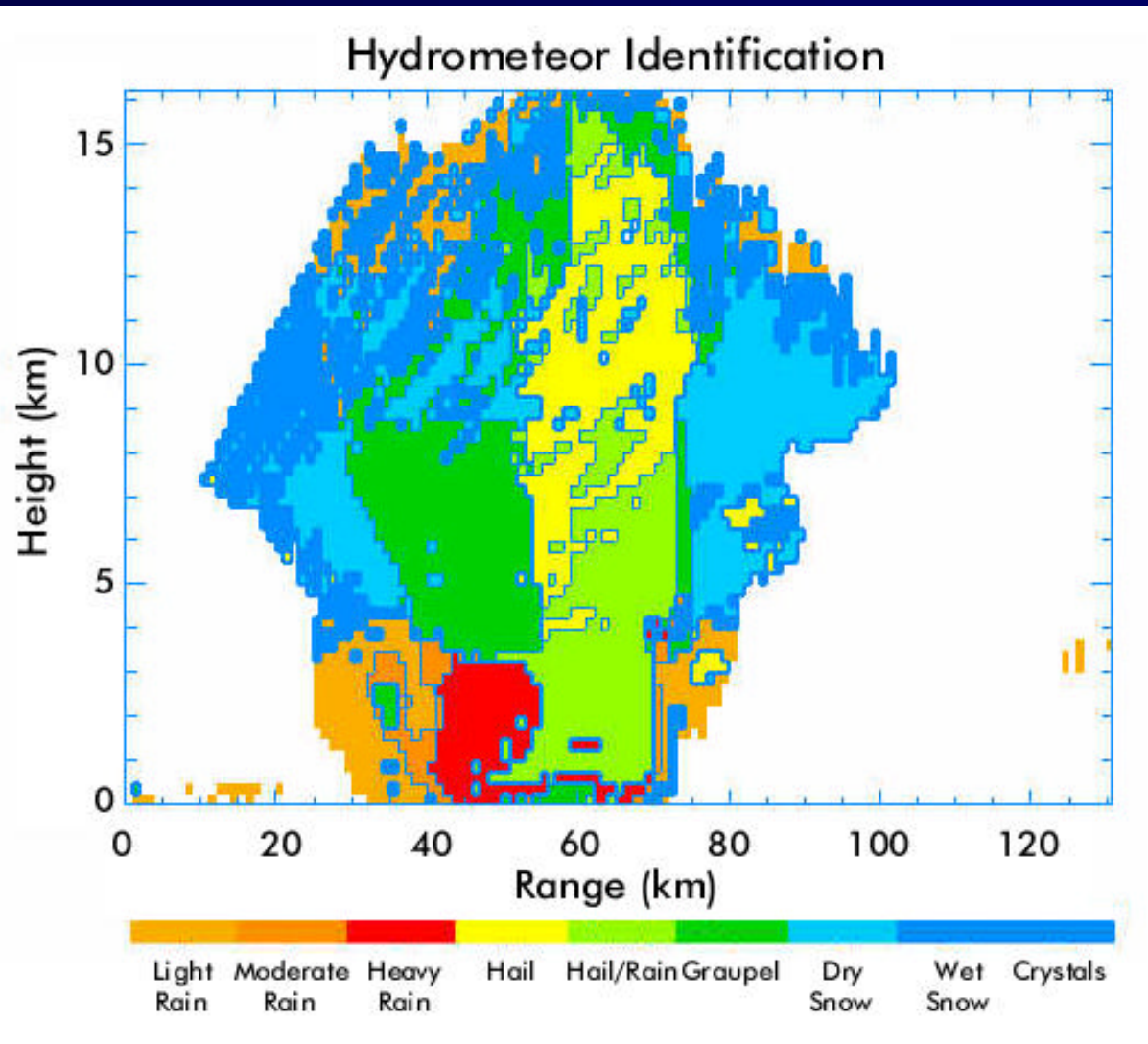


LINEAR VERTICAL





# Classification of Hydrometeors in a Hailstorm Using A Fuzzy Logic Algorithm

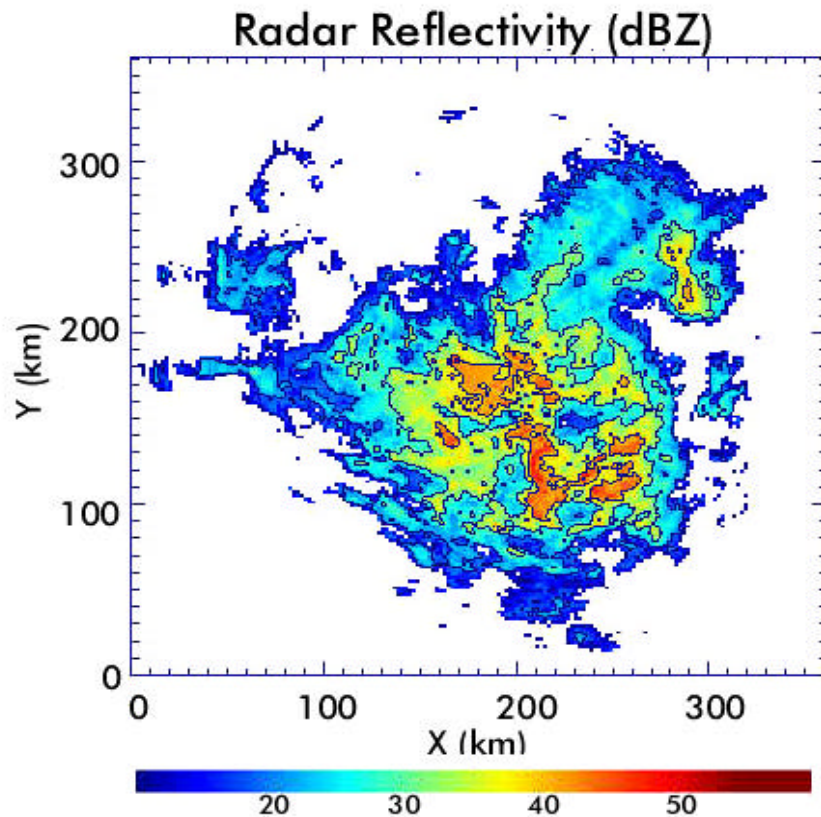




# Discrimination Between Snow, Melting Snow, and Rain

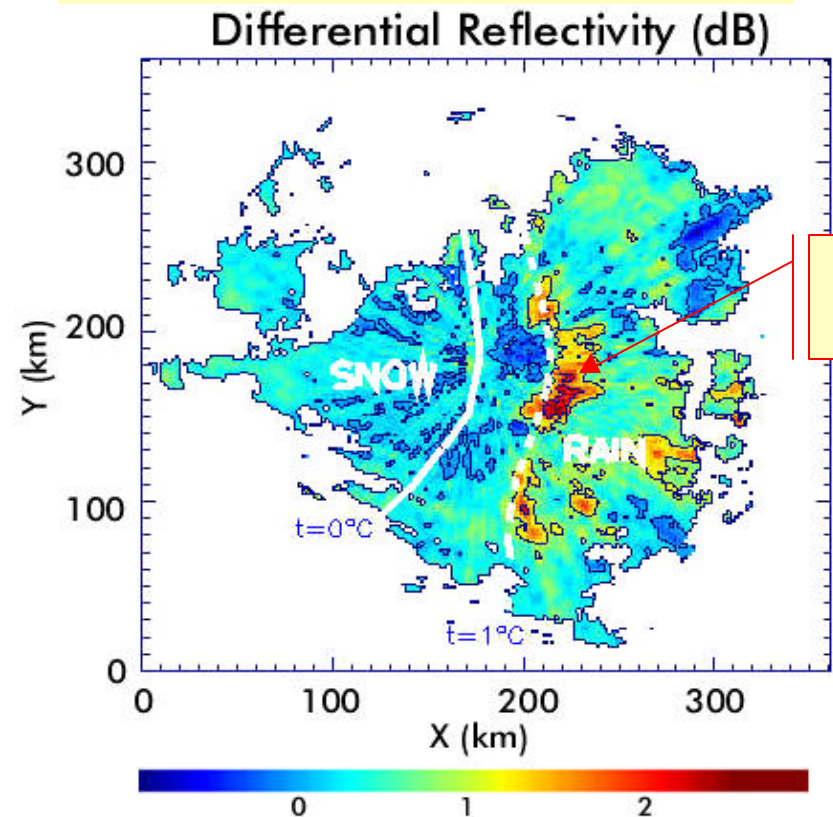
## Reflectivity

- Large Values indicate strong echo power



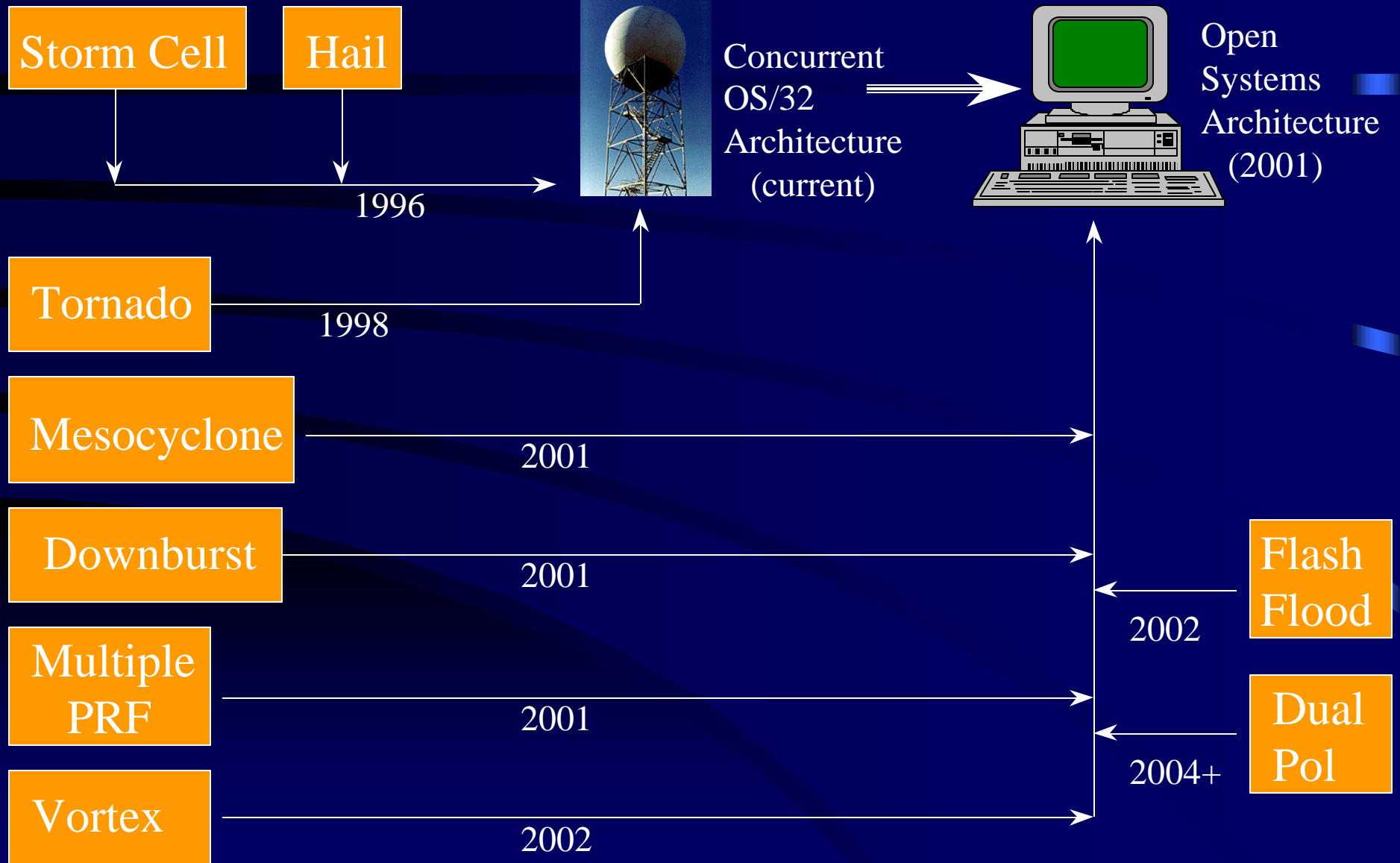
## Differential Reflectivity

- Large values indicate melting snow
- Moderate values indicate rain
- Small values indicate dry snow





# NSSL Algorithms Path to Operations

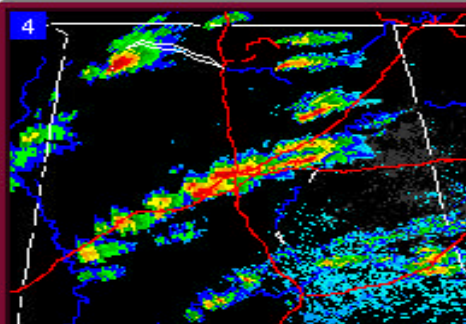
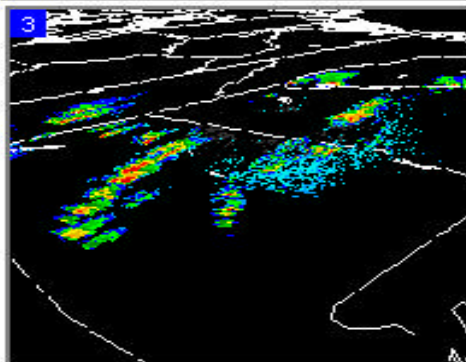
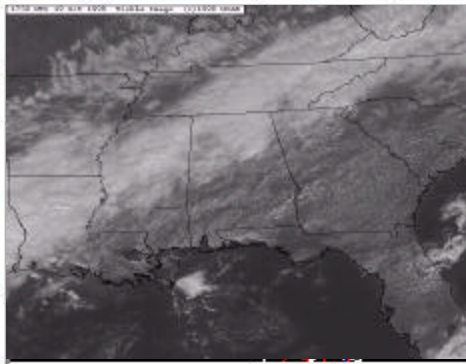
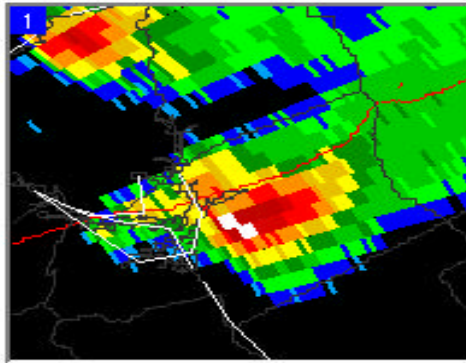




# NSSL is the R&D Leader for the NEXRAD Program

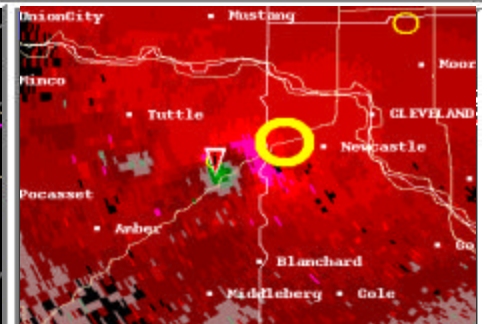
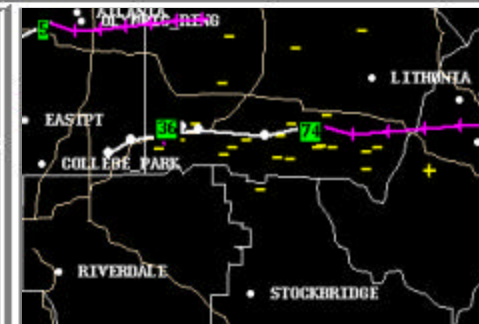
- NSSL has a broad base of expertise that allows us to take research ideas all the way to operational systems and applications
  - Meteorological Expertise
  - Image Processing Expertise
  - Severe and Hazardous Weather Detection and Short-Term Prediction
  - Engineering Expertise
  - Software Engineering Expertise
- A number of applications that NSSL has developed could be adapted for ITS.





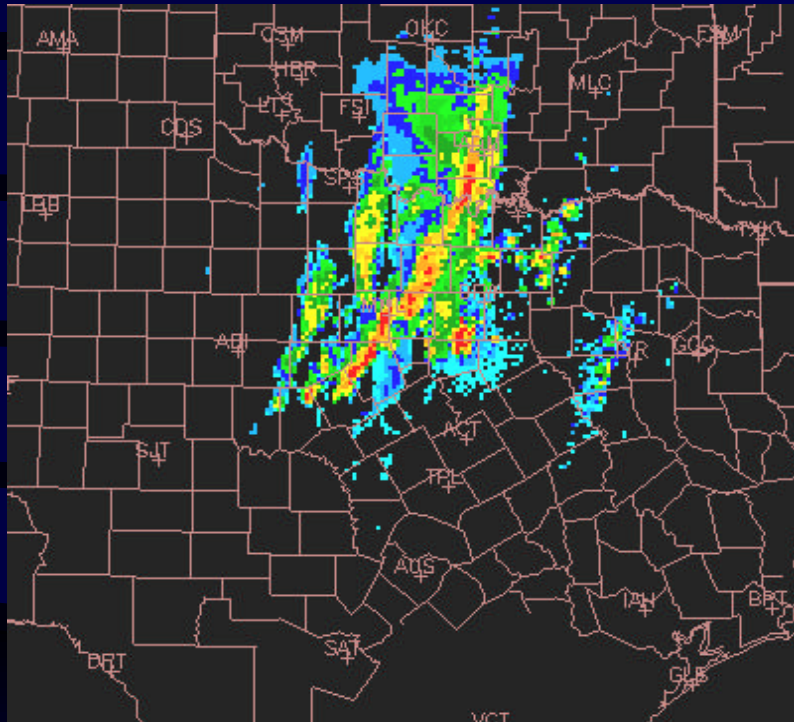
8

CELLID	AZ	RAN	CIRC	BURST	SVRH	SIZE	HAIL	VIL	MAXZ	HT MXZ	BASE	TOP	DIR/SP	SREH
36	257	54	MESO	SEVCNV	40%	2.00	100%	38	54	21	5	44	277/35	532
26	255	22	MESO	SEVCNV	30%	1.75	50%	25	59	18	8	20	243/16	407
1	265	20	CIRC	SEVCNV	50%	2.50	90%	56	58	7	1	29	249/31	424
37	307	71		SEVCNV	20%	1.75	100%	26	51	14	7	40	221/56	105
27	313	43	CIRC		30%	1.50	100%	39	56	3	3	37	225/31	310

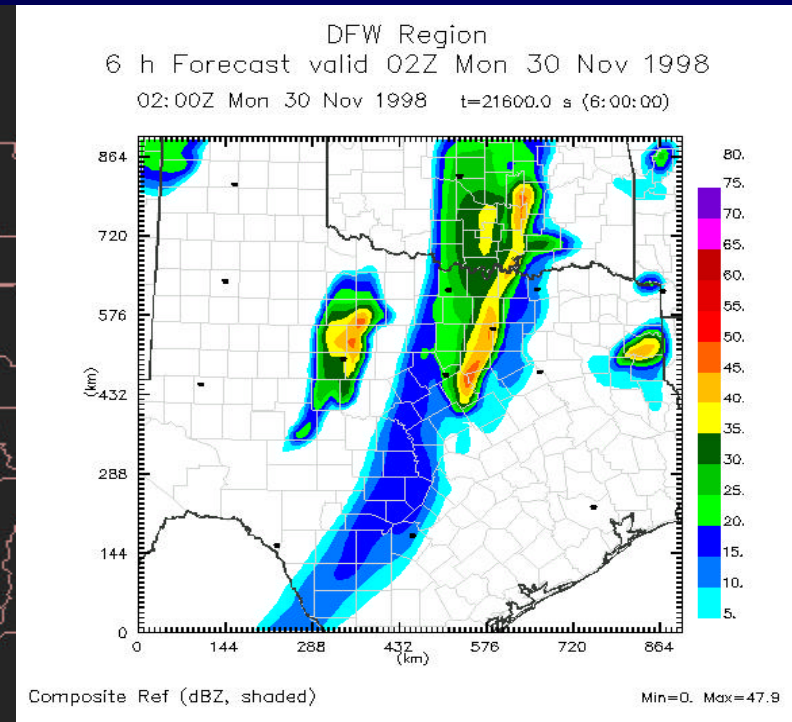




# Sample Operational 9 km ARPS Forecast From Center for Analysis and Prediction of Storms (CAPS)



Fort Worth Radar  
at 02Z on 11/30/98

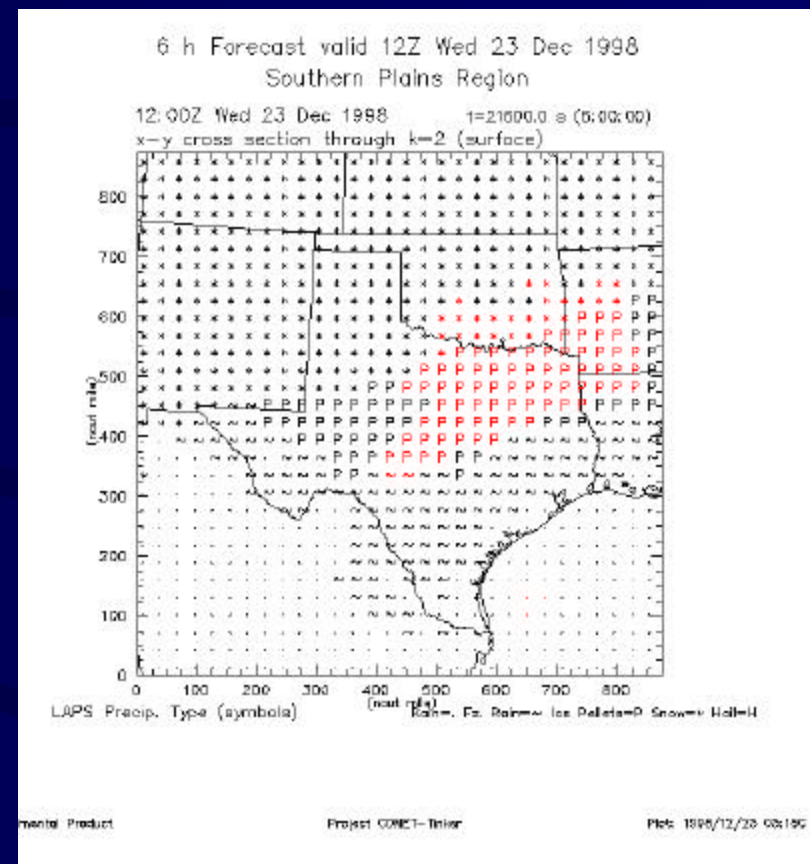
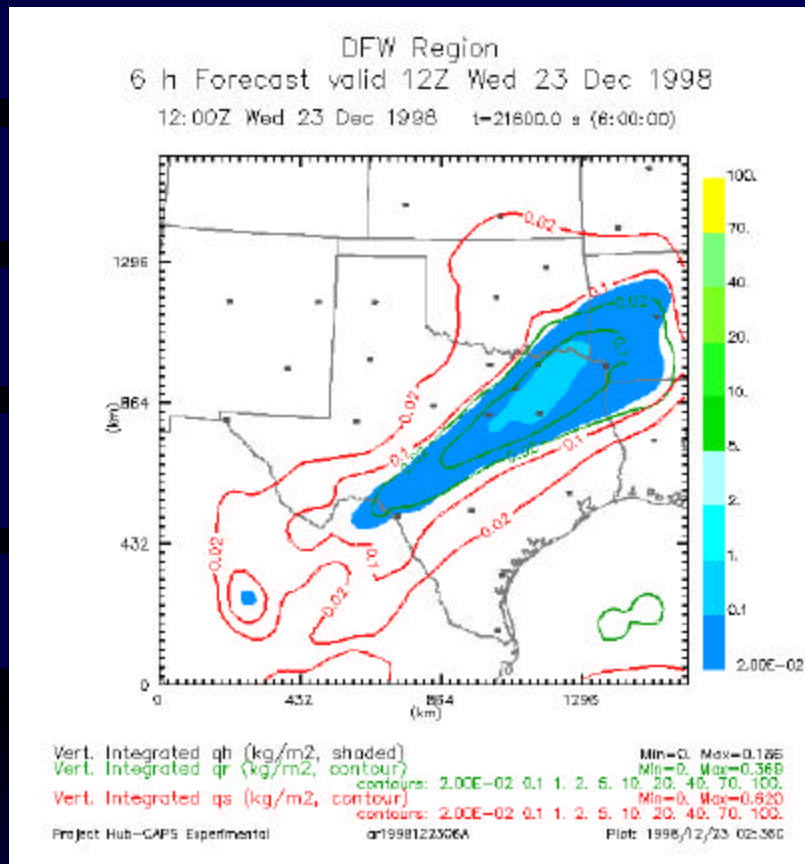


ARPS 6-hour, 9 km Resolution  
Forecast Valid at 02Z on 11/30/98





# 23 December 1998

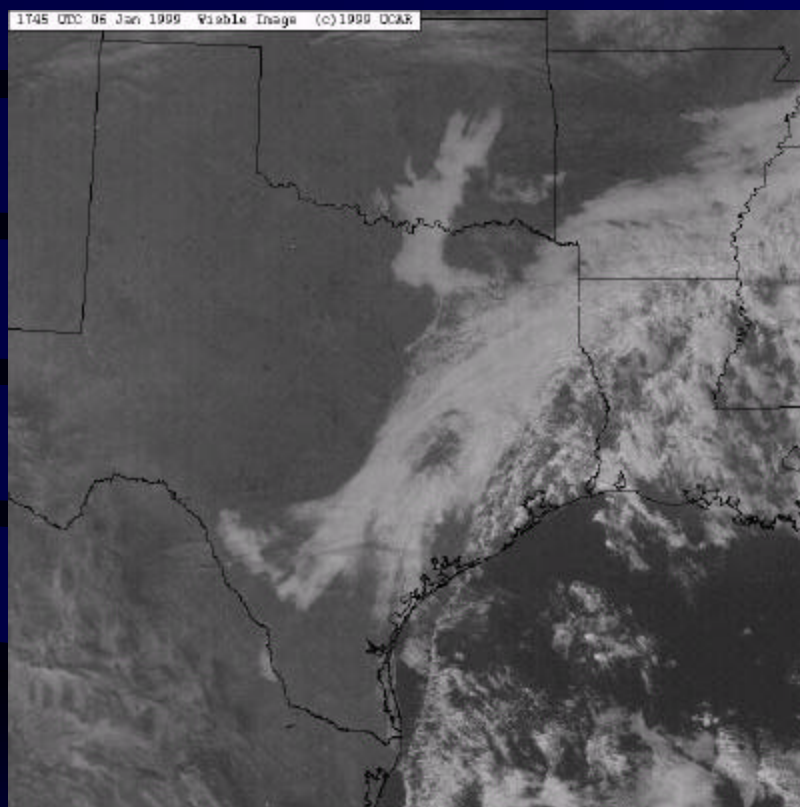


**ARPS 6 h Forecast Explicit (left) and Conditional (right)  
Precipitation Type (27 km) Valid 12Z 23 Dec 98**

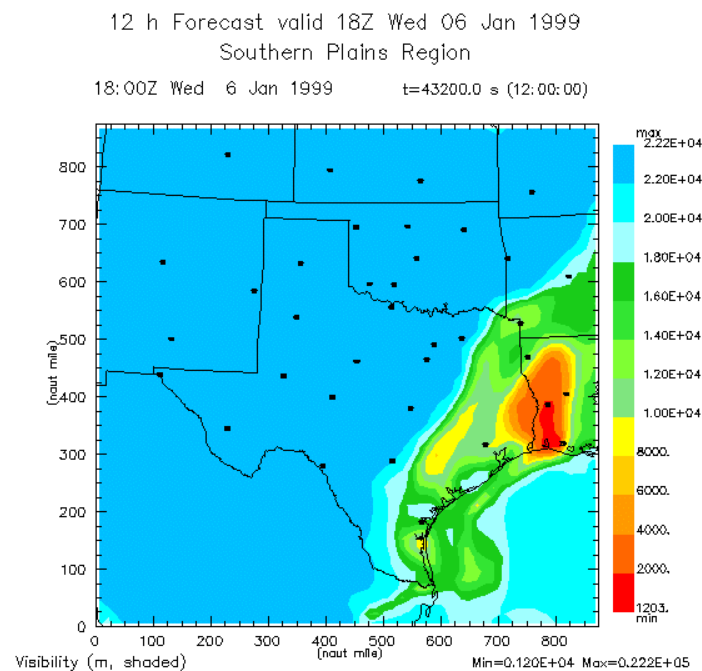




# 6 January 1999



**GOES Visible Image  
1745Z, 6 Jan 99**



**ARPS 12 h Forecast Visibility  
(27 km) Valid 18Z, 6 Jan 99**





Thank You!